NATIONAL HARMFUL ALGAL BLOOM (HAB) FORECAST SYSTEM
PACIFIC NORTHWEST

Overview:

- Twice monthly bulletin issued following the detection of a Cyanobacteria HAB by the demonstration forecast system or local water samples (typically June through October). Operational need may be more frequent.
- Bulletins issued to coastal resource managers, water treatment facilities, local, state and federal public health officials, and academic and research institutions
- Publicly available bulletin archive, posted through NOAA's Center for Great Lakes and Human Health (CEGLHH): http://www.glerl.noaa.gov/res/Centers/HABS/lake_erie_hab/lake_erie_hab.html
- Team of rotating forecasters at NOAA's National Centers for Coastal Ocean Science (NCCOS) generate bulletins during business hours; CEGLHH provides further dissemination of bulletins to subscribers (see Figure 1 below for forecast region)
- Central e-mail address for information: hab-glakes@noaa.gov
- Education and outreach in response to general public information requests are provided by NCCOS and CEGLHH

Status:

- Demonstration HAB forecast bulletins issued routinely for western Lake Erie since 2009; transition to operations at NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) tentatively planned for FY13-14.

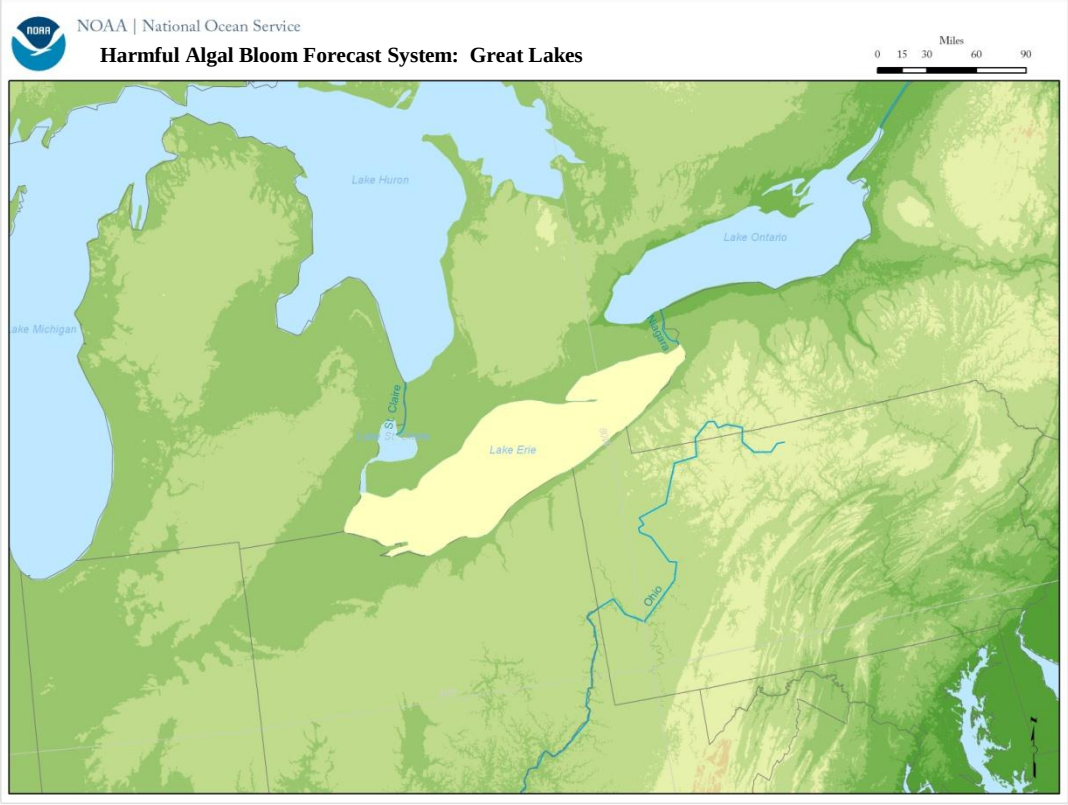

Figure 1. Delineation of NOAA's demonstration Great Lakes harmful algal bloom forecast region (shown in yellow).

December 2011

Methodology:

The HAB Bulletin is developed through expert analysis and integration of region specific oceanographic, meteorological, biological, and public health observations and modeled forecast data. Hydrodynamic model output is provided by NOAA's Great Lakes Environmental Research Laboratory (GLERL) to simulate particle (bloom) transport at NCCOS. Hindcasts, nowcasts and forecasts of bloom location are developed through a combination of imagery and model integration for Lake Erie only. A region-specific software system housed at NCCOS provides access to ocean color imagery, wind and water temperature data, HAB samples and model output to support the scientific analysis and forecasts and for the creation and dissemination of the Bulletins.

Data Sources:

- MODIS/MERIS? satellite ocean color imagery through the European Space Agency (ESA)
- NWS/NDBC meteorological observations
- NAM wind models
- GLERL's Great Lakes Coastal Forecast System (GLCFS) current models
- *In situ* biological sample data (GLERL)
- Public and animal health data (from various sources including CDC, state labs and the community)
- Particle transport tool (GNOME) developed by OR&R
- Vertical mixing model for bloom intensification and dissipation forecasts provided by NOS' Coast Survey Development Lab

Output:

- Current bloom conditions and location
- Bloom transport forecast for next 3-4 days
- *Microcystis* intensification forecast
- Change in bloom extent forecast

Management Action Supported by Forecasts:

- Provides guidance to coastal managers who regulate recreational activities and public beach warnings/closures (Agencies: State and County Health Departments, Ohio Dept. of Natural Resources, etc.)
- Initiates *in situ* monitoring response by coastal managers (Agencies: Great Lakes Environmental Research Laboratory, Ohio Environmental Protection Agency, Ohio Dept. of Natural Resources, etc.)
- Provides bloom guidance to water treatment facilities for the initiation of charcoal filtration to address public health, taste and odor impacts to drinking water supplies (Facilities: Ottawa County Regional Water System, City of Sandusky Big Island Water Works, etc.)

NOAA Partners	Role in HAB Forecasting
NOAA/National Centers for Coastal Ocean Science (NCCOS)	Experimental analysis and forecast product generation; Product development (development of bloom detection algorithms for satellite imagery); Public inquiry response; Forecast assessment; User training and continual user requirements gathering
NOAA Center of Excellence for Great Lakes and Human Health (CEGLHH)	Research development (including biology, ecology and toxicity of *Microcystis*); Bulletin dissemination to subscribers; Public inquiry response; Initial user needs and forecast requirements gathering
Great Lakes Environmental Research Laboratory (GLERL)	Hydrodynamic model development and GLCFS operations *In situ* biological sampling
NOAA Coast Survey Development Lab (CSDL)	Development of vertical mixing model for bloom intensification/dissipation
National Weather Service	Marine meteorological observations, forecasts, and wind models

Primary Role of Local Partners, Managers and the Public in Forecasting and Validation:

Partner	Role in Forecasting
Local Partners:	**Provider of *in situ* sampling, bloom confirmation, and public health impact data**
Ohio Environmental Protection Agency (EPA)	*In situ* sampling, dead fish (animal health reports) and discolored water reports
Ohio Department of Natural Resources (DNR)	*In situ* sampling
Michigan Sea Grant	Partnership building with state, county, and local managers. Outreach to Ohio environmental health and natural resource stakeholders. Weekly dissemination of bulletins. Stakeholder needs assessments and evaluation.
Florida Institute of Oceanography	Sample analysis and modeling
County Health Departments (e.g. Cuyahoga County Board of Health, etc)	On the ground reporting and sampling
Various Lake Erie Water Treatment Plants	On the ground reporting and sampling; Discolored water reporting, drinking water taste and odor reporting
Coastal and Resource Managers (those not already listed as local partners)	**Provider of public and animal health data for forecast validation**
General Public	**Provider of bloom sighting reports for forecast validation**

Forecast and Forecast Validation Limitations:

- Satellite imagery has insufficient temporal resolution at the coast for the Great Lakes.
- Ad hoc *in situ* observations of water samples (including toxicity data) lack dense spatial and temporal coverage and are insufficient to enhance the satellite data:
  - Limiting improvement of forecast quality and resolution.
  - Hindering blooms validation (for events detected by satellite imagery).
- Cloudy satellite imagery can hinder detection of blooms.
- HAB forecast accuracy relies upon the validity of oceanographic and meteorological model guidance (e.g. forecasted winds, currents, etc.). Modeled currents must be adjusted against measured currents.

Current Funding Sources for the Great Lakes HAB Forecast System:

Center for Disease Control
EPA Great Lakes Restoration Initiative
NASA
NOAA Center of Excellence for Great Lakes and Human Health
NOAA Great Lakes Environmental Research Laboratory

December 2011

Bulletin Recipients (by agency and primary role):

*Please note this is not a complete list of all Bulletin recipients

Federal Agencies:
EPA
NOAA
US Geological Survey

State and Local Agencies, Coastal and Resource Management, Public Health:
Carroll Water & Sewer District
City of Huron Water Department
City of Luna Pier
City of Monroe (Michigan)
City of Oregon Water Treatment Plant
City of Sandusky Water Treatment Plant
City of Toledo Water Treatment Plant
Cleveland Department of Health
Cleveland Metroparks
Cuyahoga County Board of Health
Erie County Health Department
Lake County Department of Utilities
Lake County General Health District
Lorain City Health Department
Lorain Water Purification Plant
Monroe County Health Department
Northeast Ohio Regional Sewer District
Ohio American Water Company
Ohio Department of Natural Resources-
Division of Parks and Recreation
Ohio Environmental Protection Agency

HAB Research and Academia:
Bowling Green State University
Heidelberg University
Michigan State University
Ohio State University
University of Michigan
University of Toledo
University of Wisconsin- Osh Kosh

Conservation and Education:
Michigan Sea Grant
Ohio Sea Grant
Western Lake Erie Water Keepers

December 2011